Revision of *Euphorbia plumerioides* Teijsm. ex Hassk. (Euphorbiaceae) and allies

Paul I. Forster

Summary

Forster, Paul I. (1994). Revision of *Euphorbia plumerioides* Teijsm. ex Hassk. (Euphorbiaceae) and allies. *Austrobaileya* 4(2): 245–264. *Euphorbia plumerioides* Teijsm. ex Hassk. has previously been confused with a number of distinct taxa in the Papuasian and Melanesian regions. A revision of the species complex, including *E. plumerioides* is provided here, and eight species are recognised, namely *E. brassii* P.I. Forst. nom. et stat. nov. (based on *E. plumerioides* var. *macrocarpa* Radcl.-Sm.), *E. buxoides* Radcl.-Sm., *E. euonymoclada* Croizat, *E. heyligersiana* P.I. Forst. sp. nov., *E. indistincta* P.I. Forst. sp. nov., *E. kanalensis* Boiss., *E. norfolkiana* Boiss. and *E. plumerioides*. *E. fidjiana* Boiss. is reduced to synonymy of *E. plumerioides*. *E. plumerioides* var. *acuminata* J.J. Sm. and *E. plumerioides* var. *microphylla* Radcl.-Sm. are reduced to synonymy of *E. kanalensis*. *E. plumerioides* is lectotypified.

Keywords: *Euphorbia* - Australia, Melanesia, Papuasia, *Euphorbia brassii*, *Euphorbia buxoides*, *Euphorbia euonymoclada*, *Euphorbia heyligersiana*, *Euphorbia indistincta*, *Euphorbia kanalensis*, *Euphorbia norfolkiana*, *Euphorbia plumerioides*.

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Introduction

Euphorbia plumerioides Teijsm. ex Hassk. and allies are woody, fleshy or ± succulent subshrubs, shrubs or small trees and have been included in *Euphorbia* Section *Balsamis* Webb & Berth. (syn. *Euphorbia* Section *Pachycladae* Boiss.) (Green 1993). Most representatives of this section (as presently defined) occur in Macaronesia; however some half dozen or so taxa have been recorded for Australia, Malesia and Melanesia and these are the subject of this paper.

Prior to this work, the complex included *E. plumerioides* with four varieties (including the 'type' variety), *E. norfolkiana* Boiss., *E. fidjiana* Boiss., *E. buxoides* Radcl.-Sm. and *E. euonymoclada* Croizat. Previous workers on this group of species have confined their studies to particular regions (e.g. New Guinea, Radcliffe-Smith 1980; Fiji, Smith 1981; New Caledonia, McPherson & Tirel 1987; McKee 1991), rather than the complex as a whole, and have not consulted the full range of herbarium collections of these taxa available. *E. plumerioides* is the earliest name available for taxa in the complex in the region. Problems exist because of the infraspecific classification proposed mainly by Radcliffe-Smith (1980). Some of the taxa are cultivated, and have been widely distributed in pre-European times throughout south-eastern Papuasia and Melanesia. Several are still widely used by indigenous peoples in New Guinea and Melanesia, for a variety of purposes but particularly as fish poisons. Hence, some taxa have quite wide 'cultivated' distributions and have been named several times from different localities. Several taxa appear to be represented only by material from cultivated plants; however, given the general lack of knowledge of biodiversity in Papuasia, this should not be construed as evidence for their absence in natural habitats or their native status (cf. Radcliffe-Smith 1980). Apart from *E. plumerioides* sensu strictu, the complex remains poorly collected, and further collections are required from New Guinea where it is likely that further related taxa remain to be discovered. As previously suggested (Forster 1991), the varieties of *E. plumerioides* as recognised by Radcliffe-Smith (1980) are con-sidered worthy of specific status. In addition, two new species have come to attention as a result of vegetation surveys in Papua New Guinea by the staff of the CSIRO in the 1960's, and require naming.

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Materials and Methods

This revision is based on herbarium collections in A, BO, BRI, BSIP, CANB, CBG, DNA, GH, K, L, MEL, NSW, P and QRS and field collections and observations of *E. plumerioides* by the author in Australia.

Herbarium collections noted by collectors as being cultivated are indicated by an asterisk * in the specimens listed below.

Taxonomy

Key to *Euphorbia plumerioides* and allies in Australia, Malesia and Melanesia

1. Stems stipulate; leaves elliptic to rhombic-elliptic, coriaceous; inflorescences comprising single, sessile involucres ..... **3. E. euonymoclada**
   Stems estipulate; leaves linear-lanceolate, oblanceolate, oblong, obovate, obovate-elliptic, fleshy or thin; inflorescence branched with several to many involucres, pedunculate 2

2. Leaf lamina with 20 or more lateral veins per side of midrib and reticulate tertiary veins visible below ..... **8. E. plumerioides**
   Leaf lamina with less than 20 lateral veins per side of midrib, or venation obscure below 3

3. Leaf lamina with lateral veins visible below 4
   Leaf lamina with lateral veins obscure below 5

4. Leaves obovate, with 16-18 lateral veins per side of midrib; involucre glands entire, not contiguous ..... **2. E. buxoides**
   Leaves oblanceolate, with 11-15 lateral veins per side of midrib; involucre glands weakly crenate, contiguous ..... **5. E. indistincta**

5. Leaf petiole scars < 1.9 mm wide; involucre glands < 0.9 mm wide ... **4. E. heyligersiana**
   Leaf petiole scars > 2 mm wide; involucre glands > 1 mm wide 6

6. Leaves sessile ..... **7. E. norfolkiana**
   Leaves petiolate 7

7. Leaf petiole scars 1-1.2 mm long; fruit capsules 4-4.5 mm long and 4.5-5 mm diameter ..... **6. E. kanalensis**
   Leaf petiole scars 1.3-2 mm long; fruit capsules 10-15 mm long and 17-27 mm diameter ..... **1. E. brassii**

1. Euphorbia brassii P.I. Forst., **nom. et stat. nov.** *Euphorbia plumerioides* var. *macrocarpa* Radcl.-Sm., *Euphorb. New Guinea* 86 (1980), non *E. macrocarpa* Boiss. ex B.L. Robinson & J.M. Greenman. **Type:** Papua New Guinea. Eastern Highlands Province: Mt Michael, 7 Sep 1959, *L.J. Brass* 31455 (holo: K!; iso: A!, CANB!, L!).

An erect small tree to 10 m high, with numerous branches, perennial, evergreen, apparently dioecious. Stems fleshy to ± succulent, rounded, up to 10 mm diameter, glabrous, waxy; with copious white latex. Stipules absent. Leaves alternate, ± fleshy, petiolate; petioles 5–20 mm long, 0.7–1.2 mm wide, glabrous, flattened on top; petiole scars crescent-shaped, 1.3–2 mm long, 2.5–3 mm wide; lamina obovate-elliptic

to oblanceolate, 18–170 mm long, 10–70 mm wide, with margins weakly revolute and midrib prominently raised below; upper surface glossy dark green, glabrous and with venation obscure; lower surface pale glossy green, glabrous and with venation obscure; tip acute to short acuminate; base attenuate to cuneate. Inflorescence of terminal to subterminal pseudocymes, up to 80 mm long and branched many times, generally extending beyond the leaves; bracts lanceolate-triangular, 1–2.5 mm long, 0.5–1.5 mm wide, glabrous, soon caducous. Involucres pedunculate, 1.5–2 mm long, 2.5–3 mm diameter, glabrous; peduncles 2–3 mm long; glands 5, ovate-elliptic, 0.8–1.8 mm long, 1.5–2.5 mm wide, entire, not contiguous; glandular processes present, up to 1 mm long, fimbriate with short hairs. Male flowers numerous, surrounding a central female flower if present; pedicels 0.6–0.8 mm long, glabrous; filaments 0.6–0.8 mm long, anthers globose, 0.2–0.3 mm long, 0.2–0.3 mm wide. Female flowers solitary in centre of involucre, sessile; ovaries globose, 1–2 mm long, 1–2 mm diameter, glabrous; styles connate at base for half of length, 1–2 mm long; stigmas shortly bifid for c. 0.3 mm. Capsules depressed globose, 10–15 mm long, 17–27 mm diameter. Seeds oblong, 8–9 mm long, 5–6 mm diameter, white-tan-brown, ecarunculate. **Fig. 1.**

***Specimens examined*: Papua New Guinea.** EASTERN HIGHLANDS PROVINCE: Slope above Akuna, Jul 1963, *Hartley* 12037 (A, CANB); Kainantu - Okapa road near Onamuga, 6°24'S,145°42'E, May 1972, *Hartley* 13695 (A, BRI, CANB); Kini Creek, NE slopes of Mt Michael, 6°25'S, 145°20'E, Sep 1959, *Womersley* NGF11371 (A, BRI, CANB, K); 2 miles [3.3 km] from Okapa, Awande Mission Station, 6°30'S, 145°35'E, Aug 1974, *Katik* LAE62192 (A, BRI, QRS); Aiyura, Sep 1951, *Womersley* NGF4464 (A, BRI). SOUTHERN HIGHLANDS PROVINCE: Vicinity of Habono rest house, 6.5 miles [10.8 km] W of Mt Ne, 6°00'S, 143°05'E, Aug 1966, *Frodin* NGF28430 (K). MOROBE PROVINCE: Yunzanig, Apr 1937, *Clemens* 6461a (A); ditto, woods near village, Aug 1936, *Clemens* 4039 (A); Boana, Jul 1938, *Clemens* 8547 (A).

***Distribution and habitat*:** *E. brassii* has been collected in Eastern Highlands, Southern Highlands and Morobe provinces in Papua New Guinea where it occurs at altitudes between 1300 and 2300 m in lower montane primary rainforest dominated by *Nothofagus* sp. and *Castanopsis* sp.. Some collectors state that the species occurs on limestone substrates.

***Notes*:** *E. brassii* does not appear to be cultivated. The species is closely allied to *E. kanalensis* but is noticeably different in its large leaf petiole scars, very large fruit and large seed.

A local common name is given in **Table 1**.

***Etymology*:** Named for Len J. Brass (1900-1971) who made the type collection of this species and whose collections have served as an inspiration for generations of botanists with an interest in the flora of Papuasia.

2. Euphorbia buxoides Radcl.-Sm., Hook. Ic. Pl. 38: t. 3724 (1974). **Type:** Papua New Guinea. EASTERN HIGHLANDS PROVINCE: Kainantu, Oct 1964, *J.S. Womersley* s.n. (holo: K [photo at BRI!]).

***Illustration*:** Radcliffe-Smith (1974: t. 3724).

An erect shrub or small tree to 7 m high, with many branches, perennial, evergreen, dioecious or occasionally monoecious. Stems woody, rounded, up to 5 mm diameter, glabrous, waxy; with copious white latex. Stipules absent. Leaves alternate to weakly subopposite, fleshy, petiolate; petioles 2–14 mm long, 1–1.5 mm wide, flattened on top, glabrous; petiole scars crescent-shaped, c. 1 mm long, 2–2.2 mm wide; lamina obovate, 8–75 mm long, 5–30 mm wide, with margins slightly revolute and midrib weakly raised below; upper surface glossy dark green, glabrous and with venation obscure; lower surface pale matt green to yellow-green, glabrous and with venation comprising 16–18 weakly developed lateral veins per side of midrib; tip obtuse, rounded or mucronate; base cuneate to attenuate. Inflorescence of terminal to subterminal pseudocymes, up to 50 mm long and branched several times, generally not extending beyond the leaves; bracts lanceolate to lanceolate-oblong, 1.5–2.5 mm long, 0.8–1.5 mm wide, glabrous, soon caducous. Involucres pedunculate, 1.8–3.5 mm long, 2–3 mm diameter, glabrous; peduncles 2–4 mm long; glands 5, semi-elliptic, 0.5–0.8 mm long, 0.8–1.5 mm wide, entire, not contiguous; glandular processes present, up to 0.8 mm long, with short hairs. Male flowers numerous, surrounding a central female flower if present; pedicels 0.4–0.5 mm long, glabrous; filaments 0.4–0.5 mm long,

Austrobaileya 4(2): 227–246 (1994)

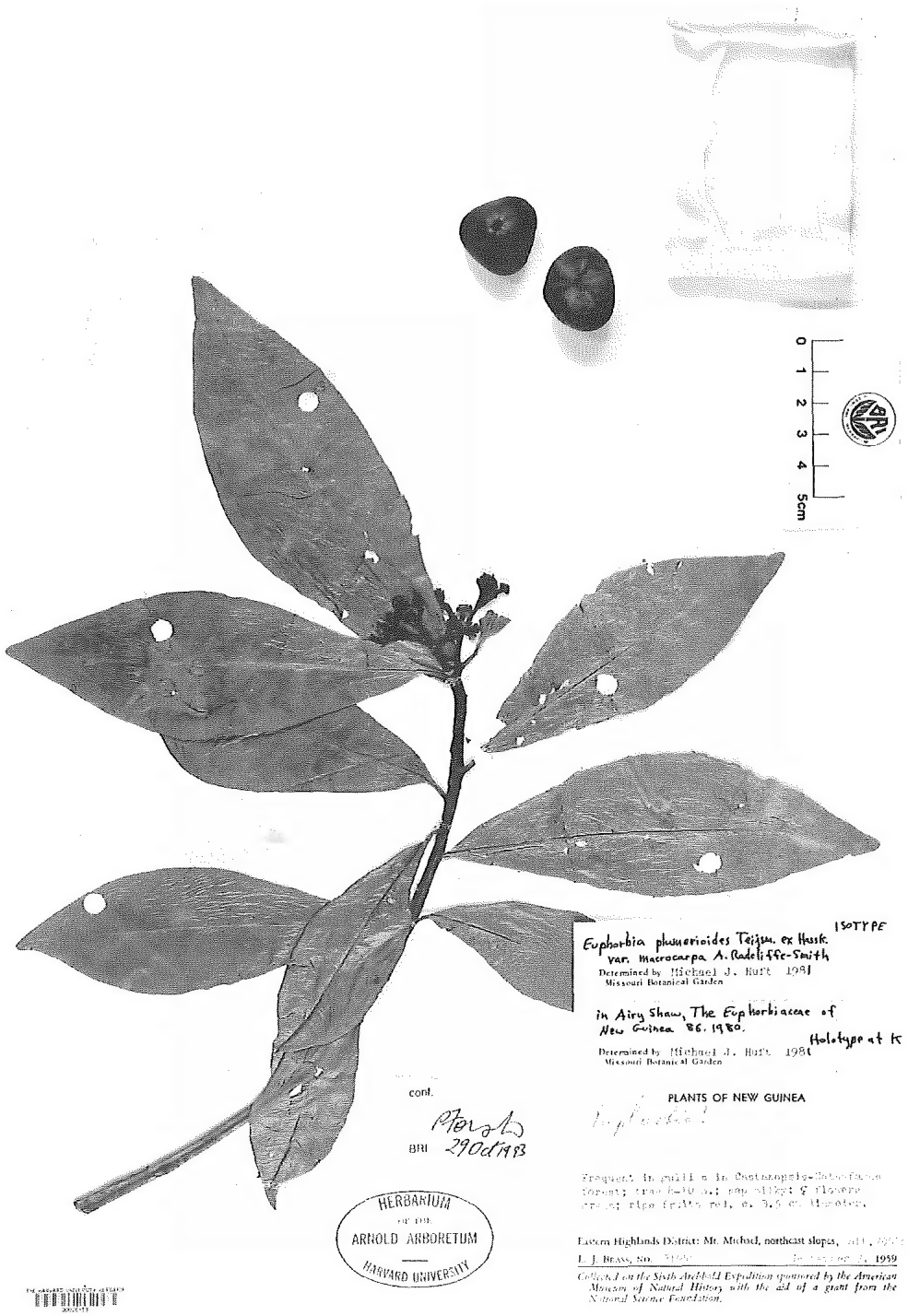

Fig. 1. *Euphorbia brassii*. Isotype. Brass 31455 (A).

anthers globose, c. 0.3 mm long, 0.2–0.3 mm wide. Female flowers solitary in centre of involucre; pedicels 0.8–1 mm long, glabrous; ovaries depressed-globose, 0.7–1 mm long, 0.7–1 mm diameter, glabrous; styles connate at base for c. half of length, 1.3–1.5 mm long; stigmas shortly bifid for 0.2 mm. Capsules and seeds not seen. **Fig. 2.**

***Specimens examined*: Indonesia, Irian Jaya.** Angi, Arfak Mts., by Iray, Lake Giji, Apr 1940, *Kanehira & Hatusima* 13655 (A, BO); Balim River, Dec 1938, *Brass* 11831* (A); Eipomek-Tal, 4°25'S, 140°01'E, Mar 1976, *Hiepko & Schultze-Motel* 1493* (K). **Papua New Guinea.** West Sepik Province: Telefomin, 5°05'S, 141°30'E, Jan 1965, *Henty* NGF20943* (K). Western Highlands Province: Mt Hagen, Feb 1970, *Lowien* NGF35516* (A, BRI, CANB); ditto, Sep 1961, *Millar & Nicholson* NGF13826* (A, BRI, CANB, K). Eastern Highlands Province: Between Wanatabi & Purosa, Okapa subdistrict, May 1972, *Hartley* 13669* (A, CANB); Chuave, 6°05'S, 147°05'E, Apr 1968, *Millar* NGF12089* (A, BRI, CANB, L); Near Okapa on Okapa - Porusa road, 6°38'S, 145°35'E, May 1971, *Stone* 10247 (BRI, CANB). Southern Highlands Province: Tigibi, Jun 1966, *Vink* 16856* (A, L); Bomkane rest house, Gembogl, 5°53'S, 143°05'E, 1970, *Hope* ANU10710* (CANB); Lake Erebo, near Hedemari Mission, Jul 1972, *Powell* UPNG2408 (L). Morobe Province: Vicinity of Kajabit Mission, Aug-Dec 1939, *Clemens* 10812 (A); Wantoat Station, Apr 1940, *Clemens* 11353* (A).

***Distribution and habitat*:** Collected in New Guinea from Irian Jaya in Indonesia; Eastern Highlands, Southern Highlands, Western Highlands, West Sepik and Morobe provinces of Papua New Guinea. Nearly all of the collections from Papua New Guinea were stated to be from cultivated plants whereas the label on *Kanehira & Hatusima* 13655 from Irian Jaya states "In the forest". This species may possibly originate in Irian Jaya; however, field work is necessary to prove this.

***Notes*:** The specimen *Kanehira & Hatusima* 13655 is labelled as the type of *Euphorbia novo-guineensis* Kaneh. & Hat. and stored in the Type room at BO. This name has never been published (van Royen 1973) and should be disregarded.

Local common names are given in **Table 1.**

***Ethnobotanical use*:** The foliage is crushed up and used as a fish poison (label data of *Powell* UPNG2408).

3. Euphorbia euonymoclada Croizat, Bull. Jard. Bot. Buitzenzorg (Ser. 3) 16(4): 357 (1940). **Type:** Irian Jaya. Wissel Lake Region, Lake Pamiai, 16 Jan 1939, *P.J. Eyma* 4357 (holo: A!; iso: BO!, K [photo at BRI!]).

An erect subshrub or shrub to 7 m high, with many branches, perennial, evergreen, apparently monoecious. Stems woody, rounded, up to 7 mm diameter, glabrous, with a lacquered red appearance; with slight white latex. Stipules linear-lanceolate to triangular, 0.5–3.2 mm long, 0.3–0.5 mm wide, glabrous, soon caducous. Leaves alternate, coriaceous, petiolate; petioles 1–8 mm long, 0.5–1.2 mm wide, flattened on top, glabrous; petiole scars crescent-shaped to semi-elliptic, 0.5–1.2 mm long, 0.8–1.2 mm wide; lamina elliptic to rhombic-elliptic, 5–60 mm long, 3–30 mm wide, with margins revolute and midrib raised below; upper surface glossy dark green, glabrous and with venation obscure; lower surface pale matt green, glabrous and with venation comprised of 8–15 weakly developed lateral veins per side of midrib; tip acute, short acuminate or mucronate; base cuneate. Inflores-cence of single, subterminal involucres, not extending beyond the leaves; bracts not seen. Involucres sessile, c. 1.5 mm long, 2 mm diameter, glabrous; glands 5, truncate-ovate, 0.8–1.8 mm long, 1.2–2 mm wide, entire, contiguous; glandular processes present, up to 0.7 mm long, fimbriate with short hairs. Male flowers numerous; pedicels 0.4–0.5 mm long, glabrous; filaments 0.5–0.7 mm long, anthers globose, 0.2–0.3 mm long, 0.2–0.3 mm wide. Female flowers solitary in centre of involucre; pedicels elongating up to 5 mm long, glabrous; ovaries ± globose, c. 1.3 mm long and 1.4 mm diameter, glabrous; styles connate at base for lower two-thirds of length, 0.8–1.4 mm long; stigmas shortly bifid for 0.2 mm. Capsules depressed-globose, 4–6 mm long, 5–8 mm diameter (immature), reddish. Seeds not seen. **Figs 3, 4.**

***Specimens examined*: Indonesia, Irian Jaya.** Wissel Lake region: trips from Post to Boebeiro, biv. Prauw. Odero to Poero, Oct 1939, *Eyma* 5431 (A). **Papua New Guinea.** Eastern Highlands Province: Tau, near Chuave, 6°00'S, 145°00'E, Jan 1962, *Womersley* NGF14104 (BRI). Northern Province: West slopes of Mt Kenive (Nisbet), 9°10'S, 147°45'E, Jul 1974, *Croft et al.* LAE65071 (A, BRI). Central Province: Suckling Complex, Mayu II, 9°45'S, 149°04'E, Jun 1972, *Stevens & Veldkamp* LAE54972 (K). Milne Bay Province: Goepon, 9°43'S, 149°02'E, Jul 1972,

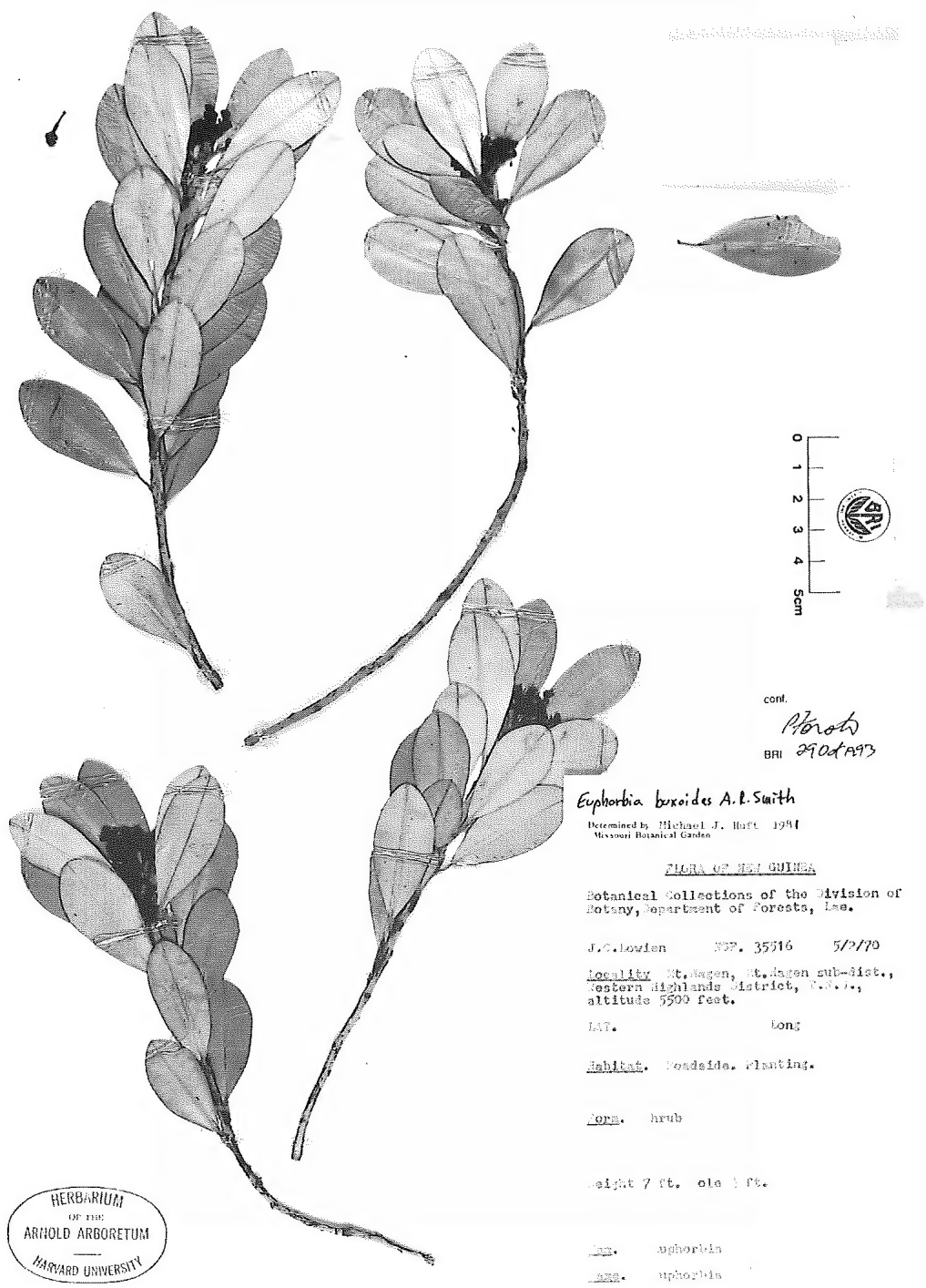

Fig. 2. *Euphorbia buxoides*. Representative specimen. Lowien NGF35516 (A).

Stevens & Veldkamp LAE55537 (BRI); North slopes of Mt Dayman, Maneau Range, Jun 1953, *Brass* 22719 (A, K); NE outlying ridge of Mt Simpson massif, 10°02'S, 149°40'E, Jul 1969, *Pullen* 7807 (A, BRI); Indup track to Mt Simpson, 10°05'S, 149°40'S, Jul 1968, *Galore & Wood* NGF41012 (K).

***Distribution and habitat*:** Collected in New Guinea from Irian Jaya in Indonesia; Eastern Highlands, Central, Northern and Milne Bay provinces of Papua New Guinea. Plants have been recorded from montane forest, sometimes on limestone, at altitudes between 1980 and 2700 m. The foliage is consistent with that on plants from microphyll moss/fern forests although the type was collected from an anthropomorphic shrubland/grassland (Croizat 1940).

***Notes*:** *E. euonymoclada* differs from the other species enumerated here in several features notably the well-developed stipules and the single-involucre inflorescences. This species may not be closely related to the others included here; however, like Croizat (1940), I am uncertain of its placement in *Euphorbia* and in the absence of an overview of the infrageneric classification of the genus, it is best treated with the others dealt with here for the present.

Unlike most of the other species enumerated here, *E. euonymoclada* has apparently been collected only from natural habitats. There is considerable variation in foliage size and shape between the collections cited above. The type and subsequent collection by *Eyma* from Irian Jaya have very small leaves that show little venation. The *Croft* collection by comparison has much larger leaves in which the venation is quite noticeable below. Some collections, such as *Womersley* NGF14104 have foliage showing both extremes. All of the collections (where fertile) have the same solitary involucres with closely contiguous glands. While I have not been able to examine this taxon in the field, similar patterns of foliage variation are noticeable in the superficially similar fern/moss thicket-inhabiting *Alyxia orophila* Domin (Apocynaceae) from Australia (Forster 1992) and are usually the result of differing degrees of exposure. Nevertheless, the species as presently circumscribed, is poorly collected and further collections may shed some light on its morphological variation.

4. Euphorbia heyligersiana P.I. Forst., **sp. nov.** affinis *E. indistinctae* P.I. Forst. a qua foliis perminoribus et plerumque oblongis apice rotundato et pagina adaxiali polita, cicatrice petiolorum lunata, et glandibus involucri integris minoribus ellipticiovatis differt. **Typus:** Papua New Guinea. West Sepik Province: 12 km N of Drelkikir, 3°23'S, 142°45'E, 5 Aug 1966, *P.C. Heyligers* 1494 (holo: CANB! [2 sheets]).

An erect subshrub to 3 m high, with numerous branches, perennial, evergreen, apparently dioecious. Stems fleshy, rounded, up to 5 mm diameter, glabrous, waxy; with copious white latex. Stipules absent. Leaves alternate, thin, petiolate; petioles 1–3 mm long, c. 0.5 mm wide, glabrous, grooved on top; petiole scars crescent-shaped, 0.7–1 mm long, 1.5–1.8 mm wide; lamina oblong or rarely oblanceolate, 4–40 mm long, 2–15 mm wide, with margins weakly revolute and midrib prominently raised below; upper surface glossy dark green, glabrous and with venation obscure; lower surface dull glaucous green, glabrous and with venation obscure; tip rounded, mucronate; base attenuate to cuneate. Inflorescence of terminal to subterminal pseudocymes, up to 100 mm long and branched several times, extending beyond the leaves; bracts lanceolate, 0.7–1.2 mm long, 0.4–0.8 mm wide, glabrous, soon caducous. Involucres pedunculate, 1–1.3 mm long, 1–1.6 mm diameter, glabrous; peduncles 1–2 mm long; glands 5, ovate-elliptic, 0.5–0.6 mm long, 0.7–0.8 mm wide, entire, ± contiguous; glandular processes present, up to 0.5 mm long, fimbriate with short hairs. Male flowers numerous; pedicels 0.4–0.6 mm long, glabrous; filaments 0.4–0.5 mm long, anthers globose, 0.1–0.2 mm long, 0.1–0.2 mm wide. Female flowers, capsules and seed not seen. **Fig. 5.**

***Distribution and habitat*:** Known only from the type specimen collected in 18 m tall secondary forest with an open canopy dominated by *Althoffia* sp. and with a dense subcanopy dominated by *Villebrunnea* sp. and *Laportea* sp. at an altitude of 515 m.

***Notes*:** *E. heyligersiana* is a distinctive small-leaved species that is allied to *E. indistincta* but differs from that species in its much smaller

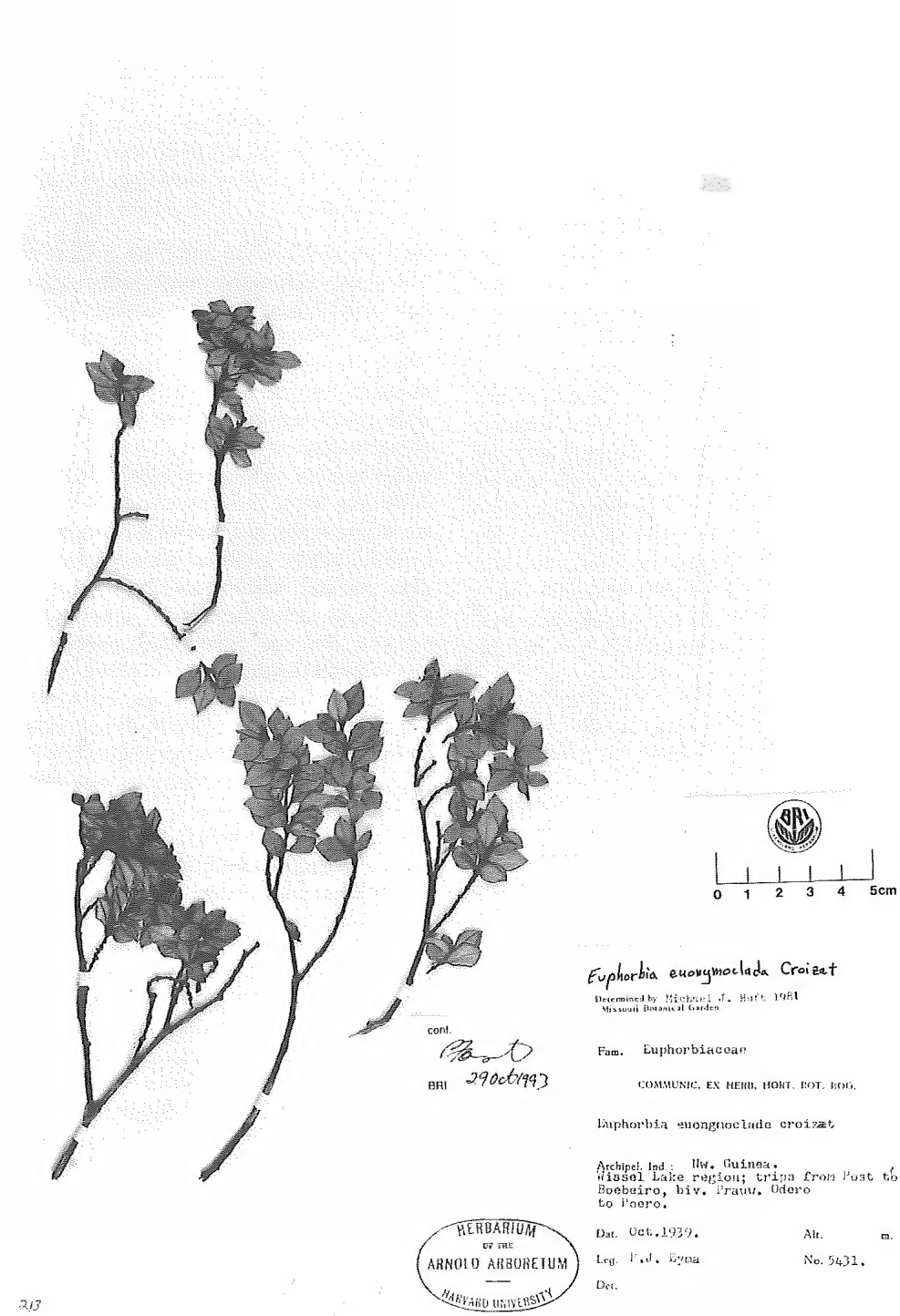

Fig. 3. *Euphorbia euonymoclada*. Small-leaved form from type locality. Eyma 5431 (A).

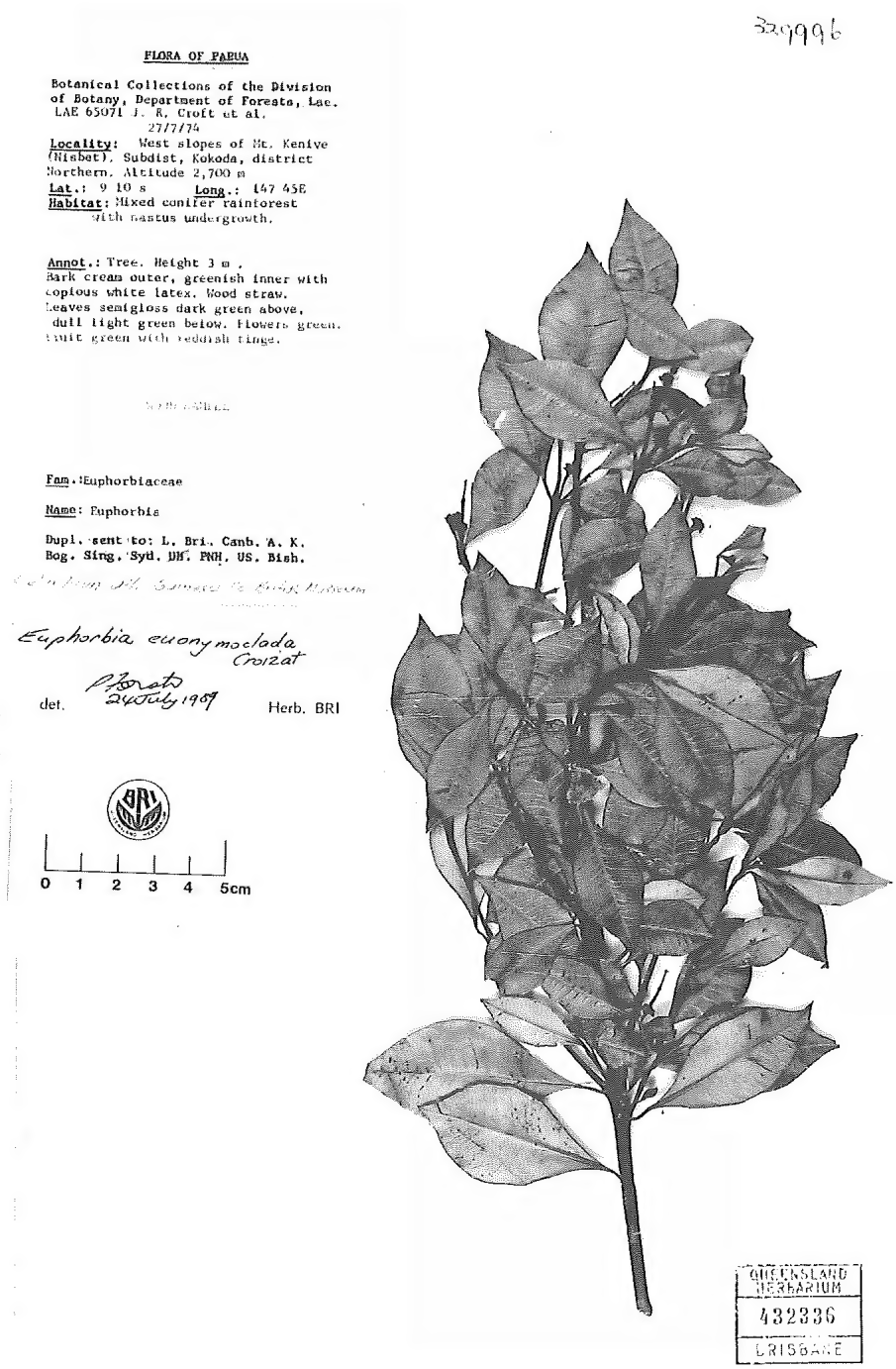

Fig. 4. *Euphorbia euonymoclada*. Large-leaved form with well-developed venation. Small leaves lack obvious venation. Croft et al. LAE65071 (BRI).

mainly oblong leaves with a glossy upper surface and rounded tips, crescent-shaped petiole scars and entire, smaller and elliptic-ovate involucre glands.

***Etymology*:** Named for the collector of the type, Petrus Cornelis Heyligers (b. 1931), plant ecologist formerly with the CSIRO Division of Land Research in Canberra, Australia.

5. Euphorbia indistincta P.I. Forst., **sp. nov.** affinis *E. kanalensi* Boiss. et *E. brassio* P.I. Forst. a qua foliis apice plerumque longiacuminato pagina hebetata adaxialiter atrovirenti et abaxialiter glaucescenti et venatione indistincta differt. **Typus:** Papua New Guinea. West Sepik Province: near Marok Village, 8 Jun 1961, *P.J. Darbyshire* 7889 & *R.D. Hoogland* (holo: CANB! [1 sheet]; iso: A!, BO!, BRI!).

An erect shrub to 4 m high, with several to numerous branches, perennial, evergreen, monoecious. Stems fleshy to ± succulent, rounded, up to 6 mm diameter, glabrous, waxy; with copious white latex. Stipules absent. Leaves alternate, thin, petiolate; petioles 5–16 mm long, c. 1 mm wide, grooved on top, glabrous; petiole scars semi-elliptic, 1.3–1.5 mm long, 1.8–2 mm wide; lamina oblanceolate, 11–110 mm long, 5–27 mm wide, with margins weakly revolute and midrib prominently raised below; upper surface matt dark green, glabrous and with obscure venation; lower surface matt glaucous green, glabrous and with venation comprising 11–15 weakly developed lateral veins per side of midrib; tip long-acuminate or rarely acute on small leaves, mucronate; base attenuate. Inflorescence of terminal to subterminal pseudocymes, up to 150 mm long and branched many times, extending beyond the leaves; bracts lanceolate-ovate, 0.8–1.5 mm long, 0.5–1 mm wide, glabrous, soon caducous. Involucres pedunculate, 1.2–2 mm long, 1.2–2.5 mm diameter, glabrous; peduncles 2–2.5 mm long; glands 5, elliptic-truncate, 0.5–0.6 mm long, 0.8–1.7 mm wide, weakly crenate, contiguous; glandular processes present, up to 1 mm long, fimbriate with short hairs. Male flowers numerous, surrounding a central female flower if present; pedicels 0.4–0.5 mm long, glabrous; filaments 0.4–0.5 mm long, anthers globose, 0.2–0.3 mm long, 0.2–0.3 mm wide. Female flowers solitary in centre of involucre; pedicels up to 1 mm long, glabrous; ovaries globose, c. 1 mm long, 1.2 mm diameter, glabrous; styles connate at base for half of length, 0.7–0.8 mm long; stigmas shortly bifid for c. 0.1 mm. Capsules and seeds not seen. **Fig. 6.**

***Specimens examined*: Papua New Guinea.** Southern Highlands Province: near Wasemi, Lake Kutubu, 6°22'S, 143°07'E, Sep 1961, *Schodde* 2311 (CANB). Morobe Province: vicinity Bulung River, hill trails, Jan 1937, *Clemens* 5208 (A).

***Distribution and habitat*:** Collected in Papua New Guinea from West Sepik, Morobe and Southern Highlands provinces. Plants have been recorded from degraded fagaceous forest or the margins of a *Metroxylon* swamp at altitudes between 800 and 1950 m.

***Notes*:** *E. indistincta* is allied to *E. kanalensis* and *E. brassii* but is distinct in its usually long-acuminate tipped leaves that are glaucous below and with indistinct venation. It is also allied to *E. heyligersiana* (see discussion under that species).

***Ethnobotanical use*:** The leaves are crushed and used to stupefy fish or to kill insect larvae (label data of *Darbyshire* 7889 & *Hoogland*).

***Etymology*:** The epithet is derived from the Latin *indistinctus*, meaning indistinct, and alludes to the weakly distinct venation in the leaf lamina, as opposed to the obscure or strong venation in those of related species.

6. Euphorbia kanalensis Boiss. in DC., Prodr. 15(2): 1265 (1866). **Type:** New Caledonia. cult. Kanala, 1855-60, *Vieillard* 1139 (iso: P!).

Euphorbia plumerioides var. *acuminata* J.J. Sm., Nova Guinea 8: 794 (1912), **synon. nov. Type:** Irian Jaya. Hollandia, Humboldt Bay, 28 May 1910, *K. Gjellerup* 147 (holo: BO!; iso: L!).

Euphorbia plumerioides var. *microphylla* Radcl.-Sm., *Euphorb. New Guinea* 86 (1980), **synon. nov. Type:** Papua New Guinea. West Sepik Province: Oksapmin, 5°20'S, 142°15'E, 15 Oct 1968, *E.E. Henty, R. Isgar & M. Galore* NGF41547 (holo: K; iso: A!, BRI!).

Fig. 5. *Euphorbia heyligersiana*. Holotype (1 of 2 sheets). Heyligers 1494 (CANB).

Illustrations: J.J. Smith (1912: t. CXLII); McPherson & Tirel (1987: 15, t.9).

An erect shrub or small tree to 4 m high, with several branches, perennial, evergreen, dioecious or occasionally monoecious. Stems fleshy to ± succulent, rounded, up to 10 mm diameter, glabrous, waxy; with copious white latex. Stipules absent. Leaves alternate, ± fleshy, petiolate; petioles 2–21 mm long, 0.5–1.2 mm wide, flattened on top, glabrous; petiole scars crescent-shaped, 1–1.2 mm long, 2–3.1 mm wide; lamina obovate-elliptic to oblanceolate, 25–170 mm long, 10–40 mm wide, with margins weakly revolute and midrib prominently raised below; upper surface glossy dark green, glabrous and with venation obscure; lower surface pale glossy green, glabrous and with venation obscure; tip acute to short acuminate, sometimes weakly apiculate; base attenuate. Inflorescence of terminal to subterminal pseudocymes, up to 180 mm long and branched many times, generally extending beyond the leaves; bracts lanceolate-ovate, 1.3–2.2 mm long, 0.8–1 mm wide, glabrous, soon caducous. Involucres pedunculate, 1.2–2 mm long, 1.3–2 mm diameter, glabrous; peduncles 1.5–3 mm long; glands 5, truncate-ovate, 0.5–1.5 mm long, 1–1.8 mm wide, entire, ± contiguous; glandular processes present, up to 1 mm long, fimbriate with short hairs. Male flowers numerous, surrounding a central female flower if present; pedicels 0.7–0.8 mm long, glabrous; filaments 0.4–0.6 mm long, anthers globose, 0.2–0.3 mm long, 0.2–0.3 mm wide. Female flowers solitary in centre of involucre; pedicels 0.3–4 mm long, glabrous; ovaries globose, 1–1.2 mm long, c. 1 mm diameter, glabrous; styles connate at base for two-thirds of length, 1–1.3 mm long; stigmas shortly bifid for 0.2 mm. Capsules subglobose, 4–4.5 mm long, 4.5–5 mm diameter. Seeds oblong, c. 3 mm long, 2.2. mm diameter, grey-brown, ecarunculate. **Fig. 7.**

Table 1. Local common names for *E. plumerioides* and allies.

Species	Name	Dialect	Voucher
E. buxoides			
1.	Tombé	Not stated	Powell UPNG2408
2.	Tombé	Huli	Vink 16856
3.	Dimbin	Chimbu	Hope ANU10710
E. indistincta			
1.	Ito	Wapi	Darbyshire 7889 & Hoogland
2.	Wane	Kutubu	Schodde 2311
E. kanalensis			
1.	Ai-chup	Urip	Barrett NGF21
2.	Ohehu	Not stated	Brass 1123
3.	Sunimeno	Not stated	Waterhouse 196
4.	Ponu	Not stated	Waterhouse 454-B
5.	Tamba'a lau	Kwarae'e	Inimua BSIP6592
6.	Totongwala	Kwarae'e	Powell BSIP19458
7.	Ngane	Nangu	Powell BSIP19458
8.	Man	Not stated	Henty *et al.* NGF41547

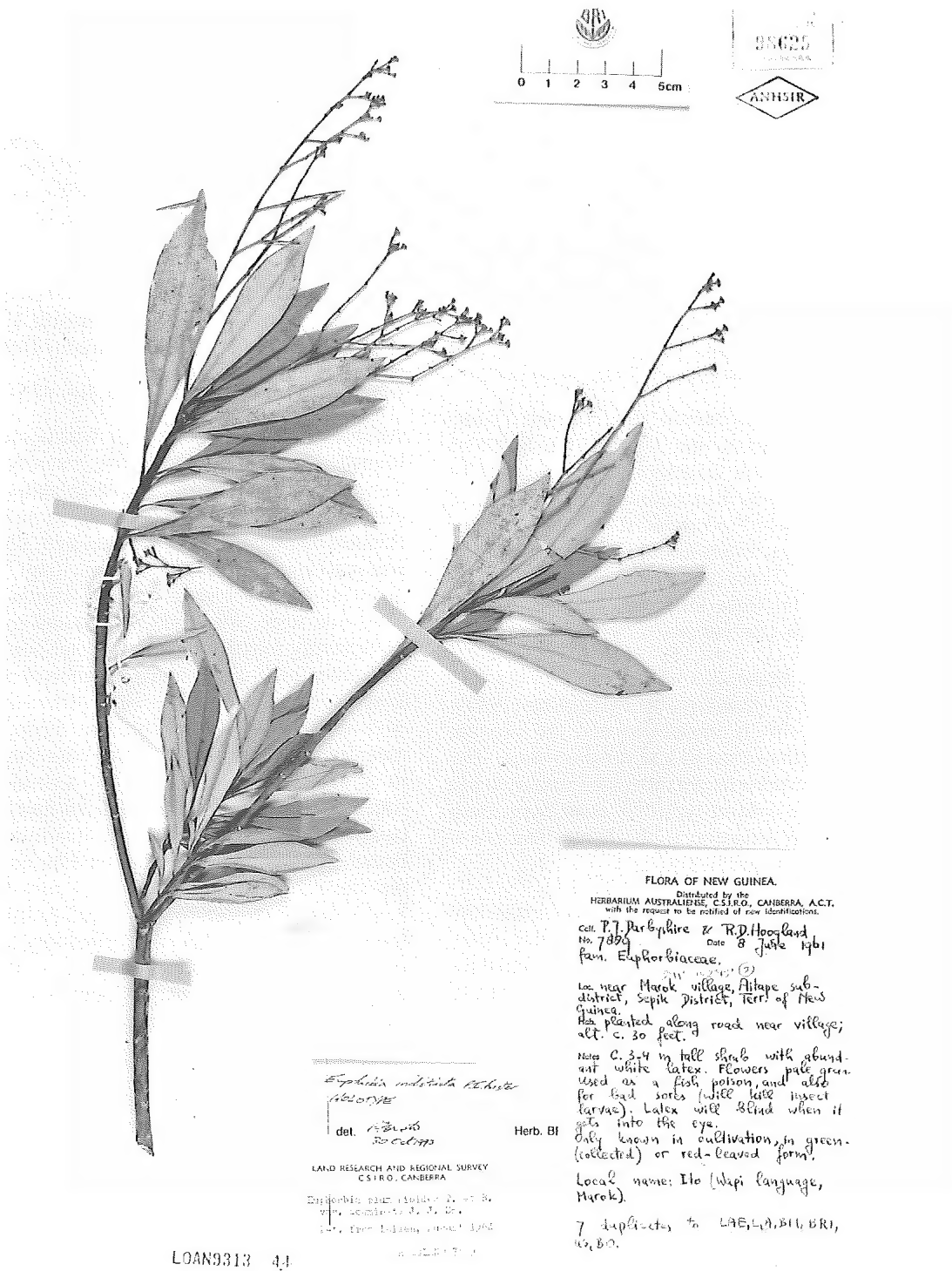

Fig. 6. *Euphorbia indistincta*. Holotype. Darbyshire 7889 & Hoogland (CANB).

***Specimens examined*: Papua New Guinea.** East Sepik Province: North of Urip Village, Dagua, Jan 1954, *Barrett* NGF21* (A, BO, BRI, CANB, K); Torricelli Geb., Apr 1902, *Schlechter* 14372 (BO); unlocalised, *Bateson* 6A (K). Bougainville Province: Siwai, Jun 1931, *Waterhouse* 454-B (L); ditto, Jul 1930, *Waterhouse* 178-B (L). New Ireland Province: Ugama, Oct 1938, *Peekel* 202 (BO); Lamekot, 1912, *Peekel* 2 (BO). Morobe Province: Aseki Valley, c. 2 miles [3.3 km] SE of Aseki, 7°23'S, 146°13'E, Apr 1966, *Schodde* 5077 & *Craven* (CANB). Southern Highlands Province: near Waro airstrip, 20 km SSW of Kutubu, 6°31'S, 143°10'E, Oct 1973, *Jacobs* 9277 (BO). Central Province: Hewa, Vailala River, Mar 1926, *Brass* 1123 (A, BRI, K). **Locality unknown:** *Atasrip* 142/440 (BO,L). **Solomon Islands.** Reef Islands: Nola, Feb 1965, *Inimua* BSIP6592 (BSIP, L). New Georgia: Jul 1929, *Waterhouse* 196* (A, L). Santa Cruz Islands: Nanggu area, Santa Cruz, Apr 1972, *Powell* BSIP19458* (BSIP, CANB). **New Caledonia.** Village de la Roche, Jan 1946, *Virot* 1585* (P); Ciga Island, Dec 1925, *Daniker* 2477 (P).

***Distribution and habitat*:** *E. kanalensis* is widespread in Papua New Guinea, the Solomon Islands and New Caledonia, but appears to be mainly cultivated or naturalised. Plants have been frequently recorded as being collected from villages, roadsides or abandoned areas of habitation. There are no records from primary forest, apart from the nomenclatural type of *E. plumerioides* var. *microphylla*.

***Notes*:** *E. kanalensis* was reduced to the synonymy of *E. plumerioides* by McKee (1991); however, this is unjustified and the two are easily distinguished by leaf venation alone. The type of *E. plumerioides* var. *acuminata* is clearly conspecific with the type of *E. kanalensis*. Both lack visible venation in the leaves that are ± glossy above and below.

E. plumerioides var. *microphylla* was only weakly differentiated by Radcliffe-Smith (1980), viz "This agrees with the type [*E. plumerioides* sensu stricta] in having the leaves dull beneath, but the leaf-outline and inflorescence are more comparable with those of var. *acuminata*. However, the foliage is much smaller than that of either var. *acuminata* or the typical variety". The type collection of *E. plumerioides* var. *microphylla* remains the only example of this particular morphological variation. I do not believe that the leaves of *Henty et al.* NGF41547 are particularly duller below than those in the range of *E. kanalensis* specimens examined, and this collection may represent a non-cultivated form of the species. Certainly the floral parts and leaves of *Henty et al.* NGF41547 fall within the range of variation of those seen for *E. kanalensis* and I have no hesitation in reducing the name to synonymy.

Local common names are listed in **Table 1**.

***Ethnobotanical use*:** The foliage is crushed and used to stupefy fish (label data of *Brass* 1123; *Barrett* NGF21; *Powell* BSIP19458), and as a purgative and vermifuge (label data of *Barrett* NGF21).

7. Euphorbia norfolkiana Boiss. in DC., Prodr. 15(2): 110 (1866). **Type:** Norfolk Island, *F. Bauer* (holo: W, *fide* Green (1994)).

***Illustration*:** Green (1994: 236, fig. 47 H–I).

An erect subshrub to 1.5 m high, with numerous branches, perennial, deciduous, monoecious. Stems ± succulent, rounded, up to 10 mm diameter, glabrous, waxy; with copious white latex. Stipules absent. Leaves alternate, thin, sessile; leaf scars crescent-shaped, c. 1 mm long, 2.2–5 mm wide; lamina oblanceolate, 20–45 mm long, 4–10 mm wide, with margins flat and midrib prominently raised below; upper surface matt dark green, glabrous and with venation obscure; lower surface pale matt green, glabrous and with venation weakly visible but difficult to ascertain vein number; tip acute; base truncate to ± cuneate. Inflorescence of terminal to subterminal pseudocymes, up to 10 mm long, comprising solitary pedunculate involucres or branched several times, not extending beyond the leaves; bracts lanceolate, 2–4 mm long, 1–1.3 mm wide, glabrous, soon caducous. Involucres pedun-culate, c. 3 mm long, 5–5.5 mm diameter, glabrous; peduncles 5–10 mm long; glands 5–10, ovate-elliptic, 0.8–1 mm long, 1.5–2 mm wide, entire, ± contiguous; glandular processes present, up to 1.5 mm long, fimbriate with short hairs. Male flowers numerous, surrounding a central female flower; pedicels 2–2.5 mm long, glabrous; filaments 0.8–1 mm long, anthers globose, 0.5–0.6 mm long, 0.4–0.5 mm wide. Female flowers solitary in centre of involucre, sessile; ovaries 4–5 mm long, 3–3.5 mm diameter, glabrous; styles connate at base for half of length, 1.8–2 mm long; stigmas shortly bifid for 0.3–0.4 mm. Capsules globose, 11–12 mm long, 10–11 mm

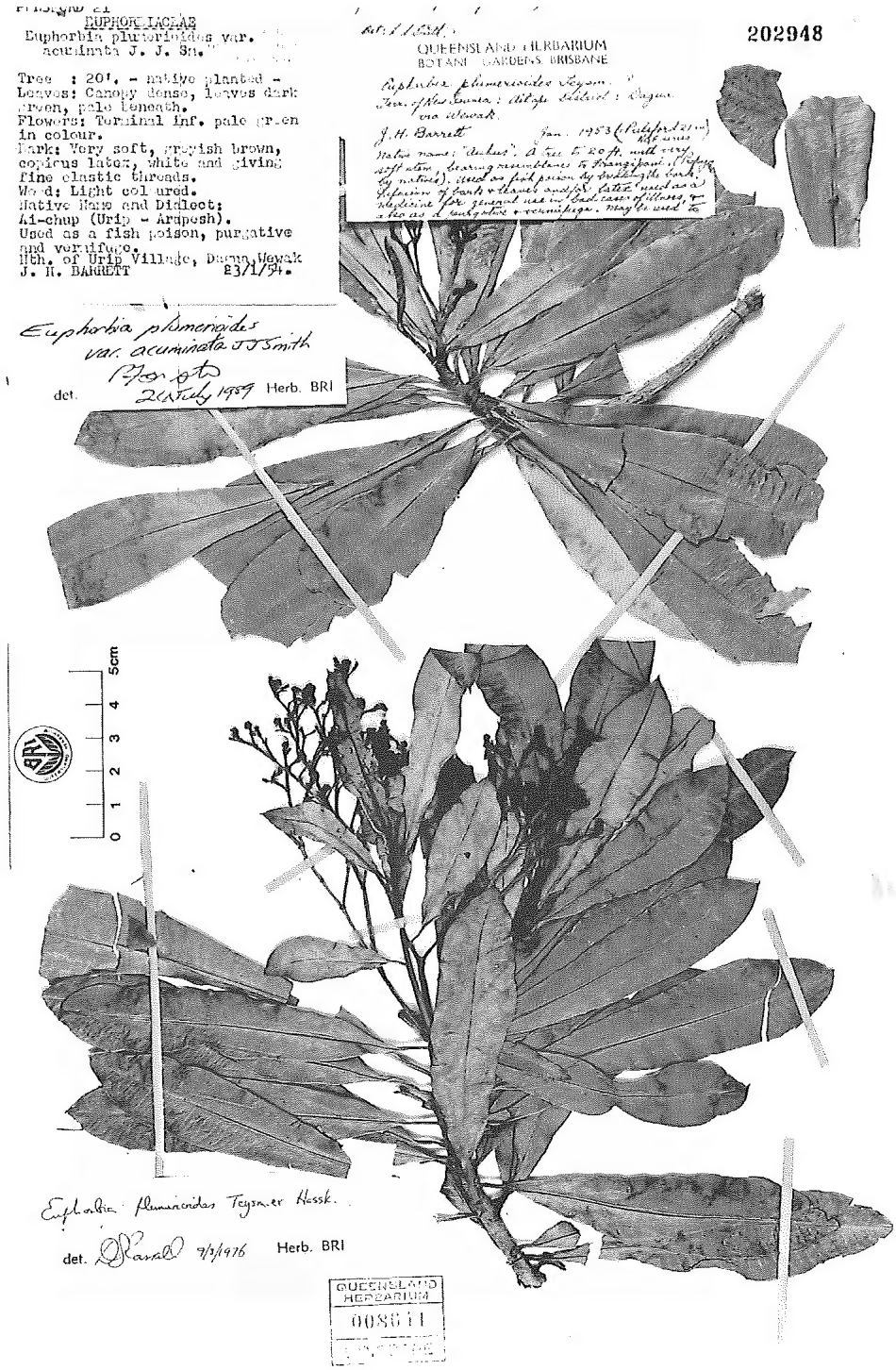

Fig. 7. *Euphorbia kanalensis*. Representative specimen. Barrett NGF21 (BRI).

diameter. Seeds ovoid, 3.5–4 mm long, 2.8–3 mm diameter, pale grey-brown; caruncle ± ovoid, 0.5–0.6 mm long, 0.5–0.6 mm wide, cream. **Fig. 8.**

***Specimens examined*: Norfolk Island.** Bumbora Reserve, Oct 1967, *Hoogland* 11189 (CANB); ditto, Aug 1973, *Webster & Evans* 18438 (GH); ditto, Jun 1987, *Richardson* 120 (CBG); ditto, Jun 1991, *Gardner* 6156 (CBG); SW coast, Apr-Jul 1939, *McCornish* 79 (K). **Locality unknown:** Jul ?, *Cunningham* 33 (K [photo at BRI!]; Mar 1835, *Backhouse* 661 (K [photo at BRI!]); *Cunningham* (K [photo at BRI!]).

***Distribution and habitat*:** *E. norfolkiana* is endemic to Norfolk Island where it occurs in open areas on headlands above the sea. There appear to be two extant localities, viz Bumbora Reserve and Ball Bay (Green 1994).

***Notes*:** Green (1993) considered that *E. norfolkiana* was "very close to *E. kanalensis* Boiss. of New Caledonia, if not conspecific". *E. norfolkiana* appears most closely related to *E. plumerioides* having similar, more or less succulent rounded stems with large leaf scars and thin oblanceolate leaves. It differs from that species in the much weaker venation in its leaves, and much larger involucres with usually more than 5 glands and larger male flowers.

***Conservation status*:** *E. norfolkiana* is a highly endangered plant on Norfolk Island. At the Bumbora Reserve, the most recent collector notes that 12 plants were seen and that seedlings were being smothered by kikuya grass (*Pennisetum clandestinum*). There is a strong case for ex-situ conservation of this plant by harvesting seed and establishing plants in botanic gardens.

8. Euphorbia plumerioides Teijsm. ex Hassk., Hort. Bog. 1: 29 (1858). **Type:** Cult. Bogor, XVK B xlx 10, *Teysm.* (lecto [here designated]: BO! [2 unnumbered sheets]).

Euphorbia fidjiana Boiss. in DC., Prodr. 15(2): 110 (1866), **synon. nov. Type:** Feejee Islands [Fiji], 1838-42, U.S. South Pacific Exploring Expedition 430 [4(c)] (iso: GH!; GH! [left hand specimen on sheet with *Seeman* 404 on right]; GH! [with additional locality information 'Maui-oui']; K [photo at BRI!].

Euphorbia corynoclada F. Muell., South. Sci. Rec. n.s. 2: 1 (1866). **Type:** Queensland. COOK DISTRICT: Woi Weer Island near Thursday Island, *Bauerlen* 68 (holo: MEL!).

***Illustrations*:** Forster (1991: 15–19).

An erect shrub or small tree to 5 m high, with 1 to many branches, perennial, deciduous, dioecious or rarely monoecious. Stems succulent to somewhat woody with age, rounded, up to 15 mm diameter, glabrous; with copious white latex. Stipules absent. Leaves alternate, thin, weakly petiolate; petioles 2–11 mm long, 0.6–1 mm wide, ± flattened on top, glabrous; petiole scars crescent-shaped, 0.8–1.5 mm long, 1.8–2.7 mm wide; lamina linear-lanceolate to oblanceolate, 10–100 mm long, 4–22 mm wide, with margins weakly revolute and midrib prominent below; upper surface matt dark green, glabrous and with venation obscure; lower surface pale matt green, glabrous and with venation comprising 20–60 lateral veins per side of midrib and poorly developed reticulate tertiary veins; tip mucronate; base attenuate to cuneate. Inflorescence of terminal to subterminal pseudocymes, up to 120 mm long and branched several times, generally not extending beyond the leaves, although often present when plant deciduous; bracts paired below involucre, triangular to oblong-oblanceolate, 1.5–6 mm long, 1–3 mm wide, glabrous. Involucres pedunculate, 2–2.1 mm long, 2.2–2.5 mm diameter, glabrous; peduncles 2–3 mm long; glands 5, ovate-truncate, 0.8–1.1 mm long, 1.5–2 mm wide, entire or distally crenate, ± contiguous, pale-green or yellow-green becoming red with age; glandular processes up to 1 mm long, sparsely fimbriate. Male flowers numerous; pedicels 2–3 mm long, glabrous; filaments 0.5–1 mm long, anthers globose, 0.3–0.4 mm long, 0.3–0.4 mm wide. Female flowers solitary in centre of involucre; pedicels 2.5–5 mm long, glabrous; ovaries c. 1 mm long and 1 mm diameter, glabrous; styles connate at base for one third of length, 0.8–1.2 mm long; stigmas shortly bifid for 0.2–0.3 mm. Capsule subglobose, 4–7 mm long, 4–9 mm diameter, reddish. Seeds ovoid, c. 2.8 mm long and 2.5 mm diameter, dark brown, ecarunculate. **Fig. 9.**

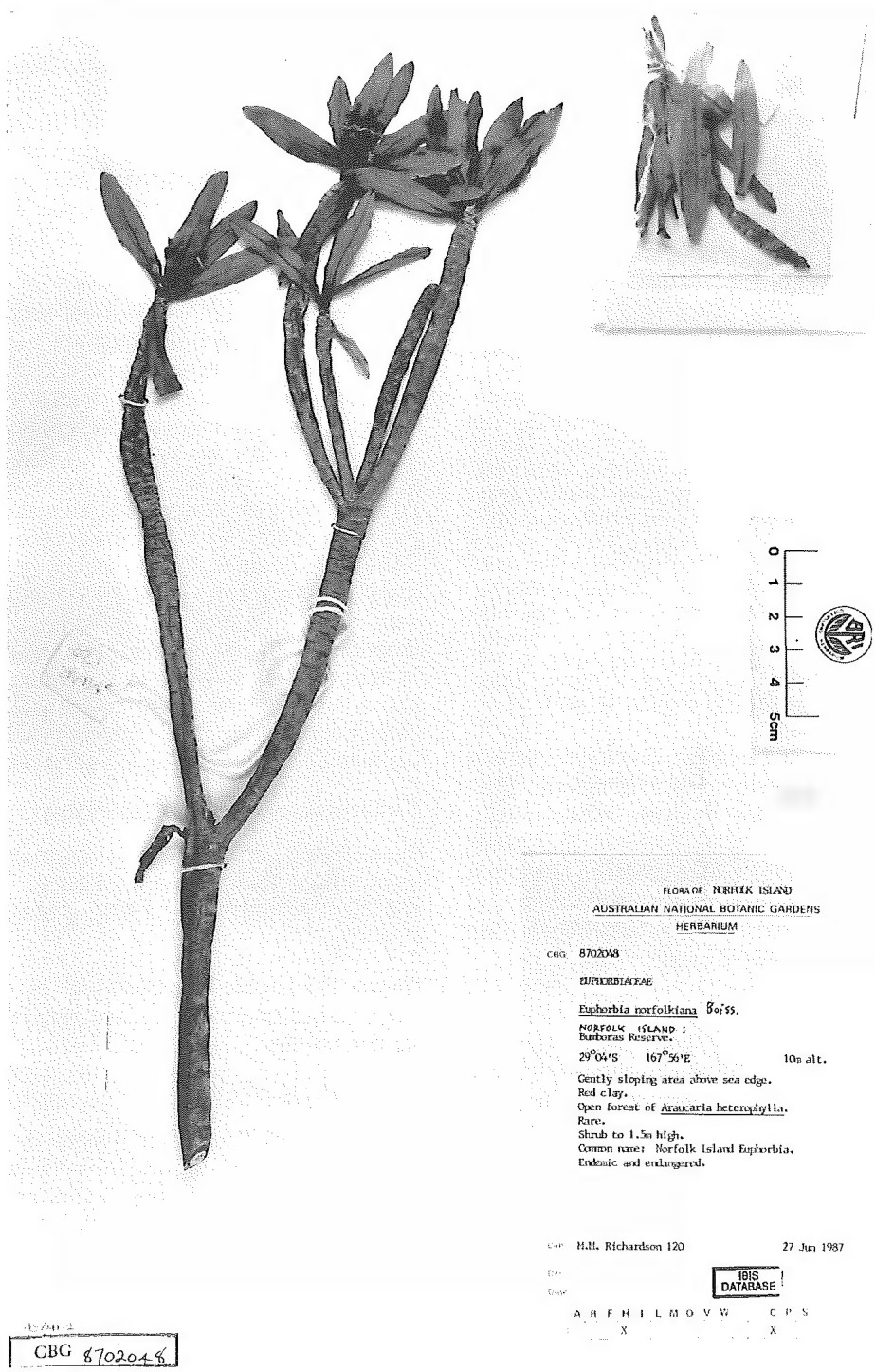

Fig. 8. *Euphorbia norfolkiana*. Representative specimen. Richardson 120 (CBG).

***Selected specimens (see also Forster 1991)*: Philippines.** Golo, Aug 1922, *Merrill* 11559 (A, BO, BRI). **Indonesia. Lesser Sunda Islands.** Bali: Noesa Penida, Sampelaan near Tanglad, May 1936, *de Voogd* 2407 (BO); Lombok, Ridjani - Vulkangebirge, Südost-Seite, Jun 1909, *Elbert* 1904 (L). **Sulawesi (Celebes).** P. Salajar, May 1913, *Docters van Leeuwen-Reijnvaan* 1894 (BO). **Java.** Kangean, Saboenten, May 1919, *Backer* 29854 (L). **Irian Jaya.** Merauke, 1904-1905, *Koch* 436 (L). **Papua New Guinea.** New Ireland Province: Ngaiagap, *Bradtke* 253* (BRI). Morobe Province: Vicinity of Kajabit Mission, Aug-Dec 1939, *Clemens* 10637 (A). Central Province: Tupuseleia, 9°35'S, 147°20'E, Aug 1967, *Streimann & Kairo* NGF30779 (A, BRI, CANB). **Australia. Western Australia.** Vansittart Bay (Seaflower Bay), 14°05'S, 126°11'E, May 1984, *Chesterfield* 390 (MEL); South West Osbourne Island, Bonaparte Archipelago, 14°26'S, 125°56'E, Jun 1973, *Wilson* 11014 (L). **Queensland.** Cook District: Thursday Island, 10°30'S, 142°20'E, Jul 1975, *Stocker* 1309 (QRS); Mt Bremer, Cape York, 10°42'S, 142°32'E, Sep 1989, *Gray* 5118 (QRS); Huxley Hill, 12°24'S, 143°12'E, Sep 1983, *Gray* 3222 (QRS); Kennedy Hill Gorge, 12°28'S, 143°15'E, Jul 1991, *Forster* 8865 (BRI, K, L, MEL); Round Mountain, Embley Range, 13°33'S, 143°30'E, Jun 1992, *Forster* 10466 *et al.* (BRI); Bathurst Range, Kalpowar Pastoral Holding, 14°18'S, 144°17'E, Mar 1993, *Fell* 2967B & *Stanton* (BRI, DNA, MBA, MEL); Cape Melville N.P., Altanmoui Range Section, 1.6 km E of Flat Hill, 14°30'S, 144°35'E, May 1993, *Fell* 3204 & *Stanton* (BRI, CANB, MEL). North Kennedy District: Double Cone Island, Whitsunday Region, 20°06'S, 148°43'E, Nov 1985, *Batianoff* 3652 & *Dalliston* (BRI). **Fiji.** 1860, *Seeman* 404 (GH, K [photo at BRI!]).

***Distribution and habitat*:** *E. plumerioides* is widely distributed in Malesia (Indonesia, Philippines, Papua New Guinea), northern Australia (Western Australia, Queensland) and parts of Melanesia (Fiji). Plants grow on headlands near the sea or in semi-deciduous microphyll to notophyll vineforests. Collections from Fiji are probably of cultivated origin.

***Notes*:** There appears to be some confusion as to the type of the name *E. plumerioides* Teijsm. ex Hassk. Hasskarl (1858) gives in the protologue "hanc ob causam *Teysmann* ceam nomine supra dicto salutavit et celerrime in hortum bot. bogoriensem transplantavit - Species haec forsan ex aliis locis introducta est et in Java occidentalis haud reperitur." Hassall (1977) in his revision of Australian Euphorbias, gave a typification of "*Type.* - ex Horto Bogoriense, Ins. Java, *J.E. Teysmann* s.n. (BO), not seen. Presumably collected by Teysmann from central Java, for the gardens at Bogor."; Radcliffe-Smith (1980) does not mention types at all and McKee (1991) gives "Type: *Zollinger 1641* (holo-, L)."

In Herbarium Bogoriense (BO) I located two sheets [photos at BRI] that appear to fulfil the requirements of the protologue. Both sheets have been remounted and lack sheet numbers; however the labels have 'Teysm. cult. Bogor' with the number 'XVK B xlx 10'. This number undoubtedly refers to the location in the Bogor Botanic Gardens where the plants were once grown. The specimen *Zollinger* 1641 (L!) (hort. Java, Jun 1858) does not agree with the protologue and cannot be regarded as a type as given by Mckee (1991).

As Hasskarl (1858) did not specifically designate a type for this name, these two sheets at BO are designated as lectotype for the name *E. plumerioides*. The name *E. fidjiana* is newly included in synonymy here. Although allied to *E. plumerioides* by various authors (e.g. Hassall 1977; Smith 1981), none of them appear to have critically accessed whether the two taxa concerned were conspecific or not. Smith (1981) states that the species is used to mark boundaries in village gardens, hence it may not be native to Fiji but only cultivated there for a long time. Certainly the populations in Australia and southern New Guinea appear native; however, the 'native' status of the other collections cited remains uncertain with even the type of the name being a garden plant.

Collections of uncertain placement

Papua New Guinea. Western Highlands Province: Alipe, Kebaka, upper Kaugel Valley, 6°05'S, 144°08'E, Jan 1963, *Bowers* 181* (CANB).

***Notes*:** This sterile collection may be *E. buxoides* but has much smaller leaves than is typical for that species.

Acknowledgements

A. Franks and G. Turpin (BRI) prepared Figs. 1–9. Collections of Australian material were made by or with the assistance of G.N. Batianoff, P.D. Bostock, D.G. Fell, G. Kenning, D. & I. Liddle, G. Sankowsky and M.C. Tucker. The Directors/Curators of the cited herbaria allowed access to collections either *in situ* or on loan. D. Liddle assisted with the visit to BO in February 1992. L. Craven (CANB) provided a copy of the Hasskarl reference and translated the diagnoses into latin.

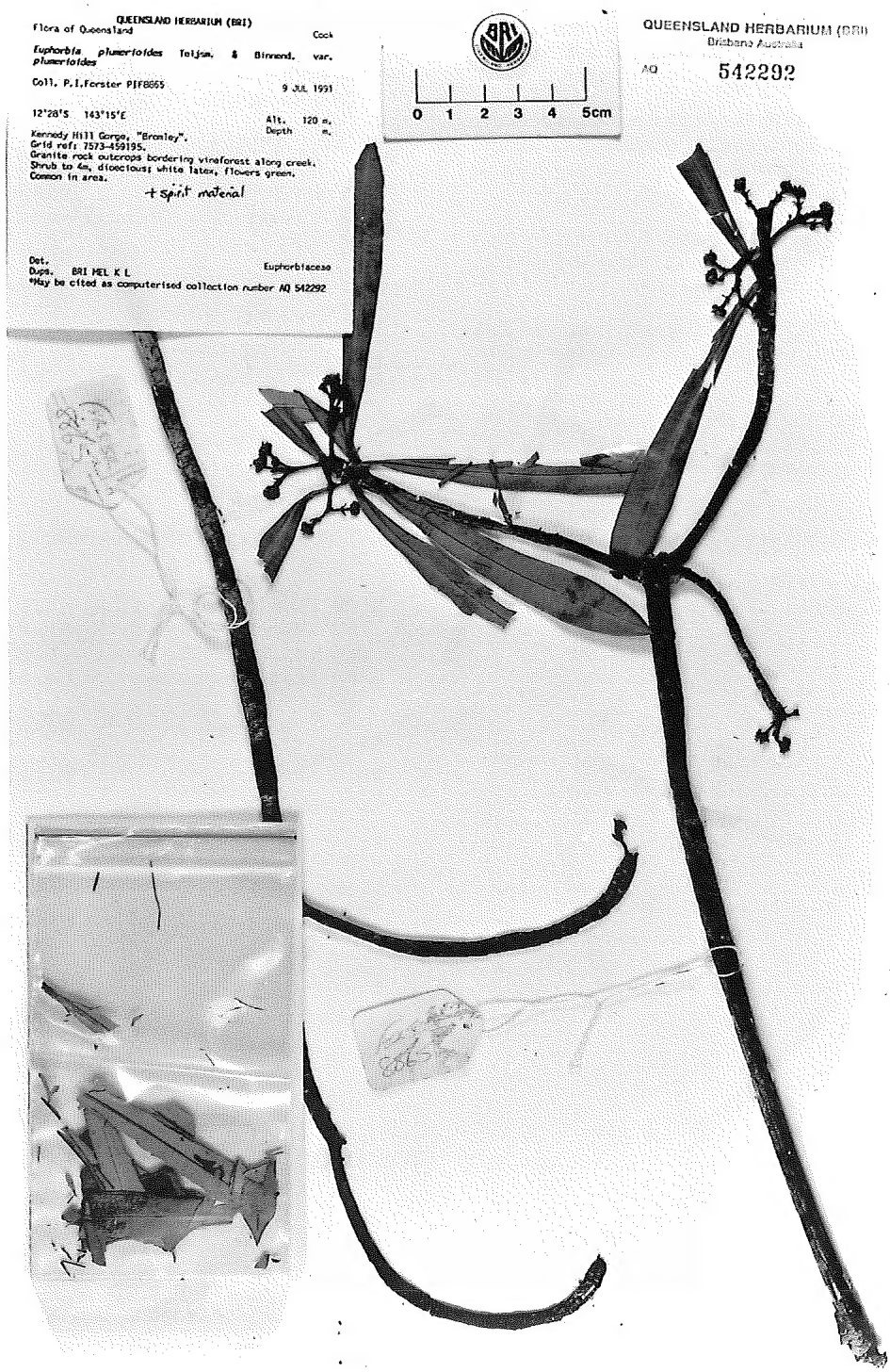

Fig. 9. *Euphorbia plumerioides*. Representative specimen. Forster 8865 (BRI).

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